

Art Unit: 2829

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09/24/04

1. (Previously presented): An apparatus that measures electrical characteristics of an electrical element within a semiconductor device in a packaged state, comprising;

an electrical characteristic measurer that is connected to the electrical element and a pad of the semiconductor device, said electrical characteristic measurer being driven in response to a control signal to output to the pad a value that is indicative of the electrical characteristics of the electrical element, the control signal being activated in an electrical characteristic measuring mode, after the semiconductor device is packaged,

wherein the pad is not connected to any output driver of the semiconductor device.

2. (Previously presented): The apparatus of claim 1, further comprising a control signal generator that receives at least one bit of an address signal that is received at the semiconductor device, and that generates the control signal responsive thereto.

3. (Original): The apparatus of claim 1, wherein the electrical element is selected from a group including an NMOS transistor, a PMOS transistor and a resistor, and the value is indicative of one of a threshold voltage and a saturation current of the NMOS transistor, one of a threshold voltage and a saturation current of the PMOS transistor, and a resistance of the resistor.

CLAIM 4 CANCELLED

5. (Original): The apparatus of claim 1, wherein the electrical element is a transistor, and the value is indicative of one of a threshold voltage and a saturation current of the transistor.

6. (Original): The apparatus of claim 5, wherein the transistor is an NMOS transistor.

7. (Original): The apparatus of claim 5, wherein the transistor is a PMOS transistor.

8. (Original): The apparatus of claim 1, wherein the electrical element is a resistor, and the value is indicative of a resistance of the resistor.

9. (Previously presented): An apparatus for measuring characteristics of an electrical element within a semiconductor device in a packaged state, comprising:

a control signal generator, coupled to receive an address signal of the semiconductor device, that generates a control signal; and

an electrical characteristic measurer, to which the electrical element is connected, that is driven responsive to the control signal to output to a first pad of the semiconductor device a value indicative of the electrical characteristics of the electrical element,

wherein the first pad is not connected to any output driver of the semiconductor device.

10. (Original): The apparatus of claim 9, wherein the electrical element is one of a transistor and a resistor, the electrical characteristic measurer comprising at least one transistor characteristic measuring unit that measures the electrical characteristics of the transistor, and a resistor characteristic measuring unit that measures the electrical characteristics of the resistor, as selectable by the control signal.

11. (Original): The apparatus of claim 10, wherein the electrical characteristics of the transistor are one of a threshold voltage and a saturation current.

12. (Original): The apparatus of claim 10, wherein the electrical characteristics of the resistor is a resistance.

13. (Original): The apparatus of claim 10, wherein the control signal generator generates the control signal responsive only to two bits of the address signal.

14. (Original): The apparatus of claim 9, wherein the control signal is generated during an electrical characteristic measuring mode, after the semiconductor device is packaged.

Claims 15-17. (Cancelled)

18. (Previously presented): The apparatus of claim 9, wherein the electrical characteristic measurer includes an NMOS transistor having a drain and a source, one of the drain and the source being connected to the first pad, and the other of the drain and the source being connected to a terminal of the electrical element, a size of the NMOS transistor being the same as a size of an NMOS transistor connected to a second pad that is connected to a data input/output pin,

wherein an output driver of the semiconductor device is connected to the second pad.

19. (Cancelled)

20. (New): The apparatus of claim 1, wherein the electrical characteristic measurer is adapted to supply a fixed current to the electrical element.

21. (New): The apparatus of claim 20, wherein the electrical element is one of an NMOS and PMOS transistor and wherein, in response to the fixed current, the electrical characteristic measurer outputs a voltage indicating a threshold voltage of the electrical element.

22. (New): The apparatus of claim 20, wherein the electrical element is a resistor and wherein, in response to the fixed current, the electrical characteristic measurer outputs a value indicating a resistance of the resistor.

23. (New): The apparatus of claim 1, wherein the electrical element is one of an NMOS and PMOS transistor and wherein the electrical characteristic measurer is adapted to supply a fixed voltage to the electrical element.